Water quality analysis of some ground water resources in Pipraich Region, Uttar Pradesh

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Abstract- **Studying the quality of water is crucial because it plays a vital role in both Earth's structures and the life forms inhabiting it. In a recent investigation, water samples were gathered from major underground sources in Pipraich region, commonly used by the local population for various purposes. Specifically, during the summer season, distinct samples were collected in glass containers and promptly transported to a laboratory for analysis. The analysis involved standard methods to assess factors such as pH, alkalinity, water hardness, chlorine levels, and total dissolved solids (TDS). The findings of the study suggest that the water from these sources is suitable for human consumption.**

INTRODUCTION

Water plays a vital role in our ecosystem because it is closely linked to essential organic and inorganic compounds found in the Earth's crust. Furthermore, it directly impacts living organisms as it is involved in nearly all biochemical reactions within living systems. Hence, it is crucial to examine the quality of water used by people in Uttar Pradesh, especially during the summer when surface water sources may not meet the demand for various activities. While surface water is primarily used for drinking, other sources like open wells, and hand pumps are tapped for additional needs. Sometimes, locals resort to groundwater for drinking and other purposes. Therefore, it is essential to assess the quality of groundwater, focusing on factors like pH, alkalinity, water hardness, chlorine, fluoride content, and total dissolved solids (TDS). During my summer break, I gathered samples from different water sources used by the residents in the Pipraich region of Gorakhpur district in Uttar Pradesh.

Location of study area

Pipraich block is in Gorakhpur district of Uttar Pradesh state having geographical coordinates 26.83°N 83.53°E. Water samples were collected from 5 different ground water resources situated at different locations in the Pipraich block.

REVIEW OF LITERATURE

In recent years, various researchers have conducted extensive studies aimed at standardizing analysis methods for groundwater quality parameters, considering the impact of chemical pesticides and other substances from daily activities. Notable contributions to this field include the work of Prajapati, R., & Yadav, R. B. (2018), who determined the water quality index of drinking water in Varanasi district, UP, India. Kumar, V., & Goswami, K. P. (2017), focused on surface water quality in Gorakhpur city, Uttar Pradesh, shedding light on the specific challenges faced by urban areas. Additionally, Sharma, K. and Sharma, S.P. (2023), conducted a thorough water quality analysis of groundwater resources in Nohar city. These studies collectively enhance our comprehension of groundwater quality, with insights from Varanasi, Gorakhpur, and Nohar contributing valuable information for environmental and public health considerations.

MATERIALS AND METHODS

The methods for quality analysis of water samples adopted in this research paper are according to Goldman *et al* (1978), Trivedi and Goyal (1984), APHA (1985), Purohit SK (1986), Saxena MM (1987) and PHED Rajasthan (1994).
Freshwater samples were collected from selected water sources in Pipraich region, using glass bottles, and immediately sent to the laboratory for detailed analysis including pH, alkalinity, water hardness, chlorine content and total dissolved solids (TDS) is included.

The **pH**, which is an important parameter of acidity or alkalinity of water, was determined using narrow range pH indicator strips in the field and after one hour, it was confirmed with a digital pH meter that these field measurements are accurate in the laboratory.

Turbidity measurements (NTU) were obtained using a calibrated digital turbidity meter, following established protocols.

Total dissolved solids (TDS) have been determined by way of taking a properly blended 100 ml pattern, filtering it via a filter out paper, and setting the filtered pattern in a weighed dish. The dish was then subjected to evaporation on a water bath. The last residue changed into transferred to a hot air oven at 180°C for as a minimum one hour, cooled, and weighed. The increase in weight of the dish represented the residue. The result was expressed as total dissolved solids at room temperature in terms of mg/l the following formula was adopted:

$$\text{TDS mg/l} = \frac{\text{mg of residue x1000}}{\text{ml of sample}}$$

Water hardness, involving the concentration of alkaline earth metal cations--calcium and magnesium--was another key indicator. Hardness (CaCO3) was measured by the EDTA titrimetric test method. In the former, 50 ml water solution containing one ml ammonia buffer solution and four or five drops of Eriochrome black T indicator was titrated with EDTA until the wine-red colour turned to blue.

Alkalinity which determines the ability of a water sample to donate hydroxide ions (OH-) or accept hydrogen ions (H+), which neutralize acids. Natural water alkalinity is generally due to presence of bicarbonates, carbonates, hydroxides of calcium, magnesium, sodium, potassium. In addition to borates, phosphates, silicates, and other rare ions are found in natural waters, such as arsenate, aluminate, and some organic ions in water with colour can also contribute to alkalinity. Alkalinity was measured by Titrimetric method (With Hydrochloric acid).

Dissolved oxygen (DO) concentration (mg/L) was precisely determined using the azide modification of the Winkler titration method.
Nitrate content (mg/L) was analysed using spectrophotometric method.
Iron concentrations (mg/L) were precisely analysed using a calibrated atomic absorption spectrophotometer, ensuring reliable results.
Fluoride concentration (mg/L) in water was determined using the Ion-Selective Electrode (ISE) method
Chloride, a common anion in water and sewage, changed into analysed using Mohr's titration approach. In this technique, a 50 ml water sample combined with 2 ml of water with K2CrO4 (potassium chromate indicator) become titrated towards zero.02N AgNO3 (silver nitrate answer) till a continual brick crimson shade appeared due to the indicator (K2CrO4). The titer reading, whilst extended by means of 14.2, provided chloride concentration in mg/l.

IMPORTANT FINDINGS

Table Showing test results for water samples

Sr No	Name of water resource	location	pH	Turbidity	TDS mg/l	TH mg/l	Alkalinity mg/l	DO mg/l	Nitrate mg/l	Iron mg/l	Fluoride mg/l	Chloride mg/l
1	Hand Pump	Pipraich Community Health Centre (CHC)	7.4	1.2	346	400	469	4.72	25	0.224	0.32	119
2	Hand Pump	Mote Shiv Mandir Campus	7.1	0.9	380	374	580	4.39	33	0.284	0.98	178
3	Hand Pump	Pipraich Railway Station Premises	6.02	1.3	370	360	346	4.23	27	0.199	0.52	154

4	Hand Pump	Rakshwapar Petrol Pump Premises	6.1	0.7	353	367	400	3.98	40	0.218	0.83	227
5	Hand Pump	Tura Nala Water Barigawan	6.2	0.8	334	399	540	4.85	19	0.257	0.52	204

pH levels in present study ranges from 6.02 to 7.4 which is in permissible limits of water for drinking purpose as well As for other uses.

Total Dissolved Solids (TDS) is a general parameter tested for drinking water, in present study the lowest TDS value is 334 mg/l and highest TDS value is 380 mg/l which is in permissible limit in all the tested samples.

Total hardness in tested samples ranges from 360 mg/l to 400 mg/l which proves that total hardness of all the samples cannot be considered as very hard, it is advised that water having hardness above 200 mg/l is not suitable for drinking purpose by human.

Total Alkalinity ranges from 346 mg/l to 580 mg/l. The values found during analysis are within permissible limit according to WHO.

Dissolved oxygen (DO) values indicate the degree of pollution in the water bodies. DO values varied from 3.98 mg/l to 4.85 mg/l.

The **nitrate** content in the study area varied in the range of 19.0 mg/l to 40.0 mg/l and found within the prescribed limit.

The values of **iron** shows that the range between 0.199mg/l to 0.284 mg/l. These values are found within permissible limit according to WHO.

Fluoride concentration in sampling sites ranges from 0.32 mg/l to 0.98 mg/l in ground water samples, all values are found in within permissible limit.

Chloride contents estimation also represents the presence of various salts in water. In tested samples the lowest value is 119 mg/l and highest value is 227 mg/l.

CONCLUSION

The analysis of ground water samples being collected from the different places of Pipraich Block of Gorakhpur District and all water quality parameters (pH, electrical conductivity, turbidity, total alkalinity, total hardness, chloride, nitrate, fluoride, iron, TDS, and DO are within the permissible limit as per WHO standards. In Pipraich block, the parameters analysed have shown that they all are within the permissible limits for drinking water. It is safe for human being.

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